Amendments to the Specification

Please replace the paragraph beginning at page 5, line 4, with the following rewritten paragraph:

In one embodiment of the present invention [[~~invention~~]], DNA hybridization on a silica microsphere surface is quantified from the red-shift of an optical resonance wavelength. The present invention may use the fact that the fractional shift of a resonance wavelength $\delta\lambda/\lambda$ may be expressed as $\alpha_{ex}\sigma_s/[\varepsilon_0 (n_s^2-n_b^2)R]$, where ε_0 is the vacuum permittivity, R is the microsphere radius (200 μm), n_s (1.467) and n_b (1.332) are the refractive indices of the microsphere and the buffer solution, respectively. α_{ex} is the excess polarizability (the polarizability of a volume of DNA (or some other target nucleotide chain) in excess of an equal volume of water) and σ_s is the surface density of the bound DNA (or other target nucleotide chain)[[~~,~~]] to determine the surface density of bound DNA target molecules.

Please replace the paragraph beginning at page 8, line 6, with the following rewritten paragraph:

The light source 120 may be a laser diode, such as a tunable, distributed feedback laser diode (e.g., 1312.8 nm nominal wavelength, 5 mW, ML776H11F from Mitsubishi of Japan). The optical fiber 110 may be a single mode optical fiber such as smf-28 optical fiber (e.g., from Canadian Instrumentation & Research Ltd. of Ontario, Canada). The detector 130 may be an InGaAs photodetector (e.g., PDA400, from Thorlabs of Newton,

NJ). The microspheres 140,150 may be silica microspheres evanescently coupled to the fiber 110.

Please replace the paragraph beginning at page 9, line 20, with the following rewritten paragraph:

The use of a microspheres to detect a substance, as well as fabrication of such microsphere-based detection systems and their components are described in: U.S. Patent Application Serial No. 10/096,333 (referred to as "the '333 application" and incorporated herein by reference), issued as U.S. Patent No. 7,491,491 on February 7, 2009, titled "DETECTING AND/OR MEASURING A SUBSTANCE BASED ON A RESONANCE SHIFT OF PHOTONS ORBITING A MICROSPHERE," filed on February 12, 2002, and listing Stephen Arnold and Iwao Teraoka as inventors; U.S. Patent Application Serial No. 10/690,979 (referred to as "the '979 application" and incorporated herein by reference), titled "ENHANCING THE SENSITIVITY OF A MICROSPHERE SENSOR," filed on October 22, 2003 and listing Stephen Arnold, Iwao Teraoka and Frank Vollmer as inventors; and U.S. Patent Application Serial No. 10/735,247 (referred to as "the '247 application" and incorporated herein by reference), titled "USING A CHANGE IN ONE OR MORE PROPERTIES OF LIGHT IN ONE OR MORE MICROSPHERES FOR SENSING CHEMICALS USHC AS EXPLOSIVES AND POISON GASES," filed on December 12, 2003 and listing Stephen Arnold, Iwao Teraoka, Yoshiyuki Okamoto and Frank Vollmer as inventors. Each of the foregoing applications is incorporated herein by reference. As will be appreciated by those skilled in the art, various teachings from those applications can be used in concert with the present invention.

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1 (currently amended): For use in a system including a light source, and a light detector, for measuring [[~~one or more of at least two~~]] a target substance [[~~substances, each of the at least two target substances~~]] including a chain of nucleotides, a sensor comprising:

a) at least one optical carrier;

b) at least two optical cavities, wherein each of the at least two optical cavities is [[~~1) being~~]] optically coupled with the optical carrier, [[~~and~~]] wherein a first of the at least two optical cavities has [[~~2) having~~]] a surface including first oligonucleotides complementary to [[~~a particular one of the at least two~~]] the target substance [[~~substances~~]], and wherein a second of the at least two optical cavities has a surface including second oligonucleotides complementary to a second oligonucleotide having only a single nucleotide mismatch with the target substance,

wherein, when light is applied to the optical carrier, a resonance within each of the optical cavities is excited,

wherein, if a target substance hybridizes with oligonucleotides on the surface of an optical cavity, a shift in the resonance of that optical cavity occurs, and

wherein a measurement of the target substance can be determined based on the shift in resonance.

Claim 2 (original): The sensor of claim 1 wherein the optical carrier is an optical fiber.

Claim 3 (original): The sensor of claim 1 wherein at least one of the optical cavities is a microsphere.

Claim 4 (original): The sensor of claim 1 wherein at least one of the optical cavities is a toroidal microcavity.

Claim 5 (currently amended): The sensor of claim 1 wherein at least one of the optical cavities is an Indium Phosphide [[~~a InP~~]] microdisk.

Claim 6 (currently amended): The sensor of claim 1 wherein [[~~at least one of~~]] the first oligonucleotides are complementary to a target [[~~substances is~~]] DNA.

Claim 7 (currently amended): The sensor of claim 1 wherein [[~~at least one of~~]] the first oligonucleotides are complementary to a target [[~~substances is~~]] RNA.

Claim 8 (original): The sensor of claim 1 wherein, if a target substance hybridizes with oligonucleotides on the surface of an optical cavity surface, a shift in the resonance of that optical cavity of a first amount occurs, and

wherein if a substance which differs from the target substance by a single nucleotide is made available for hybridization with the surface of the optical cavity surface, a shift in the resonance of the optical cavity of a second amount occurs, wherein the first amount is detectably greater than the second amount.

Claim 9 (original): The sensor of claim 8 wherein the

first amount is at least ten times greater than the second amount.

Claim 10 (original): The sensor of claim 1 wherein the oligonucleotides provided on at least one of the optical cavities are 11-mer oligonucleotides.

Claim 11 (original): The sensor of claim 1 wherein the oligonucleotides provided on at least one of the optical cavities are at least 27-mer oligonucleotides.

Claim 12 (original): The sensor of claim 1 wherein the oligonucleotides provided on at least one of the optical cavities are at least 11-mer oligonucleotides.

Claim 13 (original): The sensor of claim 1 wherein the oligonucleotides provided on at least one of the optical cavities are at most 27-mer oligonucleotides.

Claim 14 (currently amended): A system for measuring one or more of at least two target substances, each of the at least two target substances including a chain of nucleotides, the system comprising:

a) a light source;

b) a light detector;

c) a sensor, the sensor including

1) at least one optical carrier optically coupled with both the light source and the light detector;

2) at least two optical cavities, each of the at least two optical cavities

A) being optically coupled with the optical

carrier, and

B) having a surface including oligonucleotides complementary to a particular one of the at least two target substances,

wherein, when the light source applies light to the optical carrier, a resonance within each of the optical cavities, having a first characteristic, is excited and is detected by the detector, and

wherein, if a target substance hybridizes with oligonucleotides on the surface of an optical cavity, a change in the characteristic of the resonance of that optical cavity occurs and is detected by the light detector; and

d) a processor for determining a measurement of the target substance using a difference [[~~a shift~~]] in shifts between the [[~~characteristic of the~~]] resonances detected by the light detector.

Claim 15 (original): The system of claim 14 wherein the optical carrier is an optical fiber.

Claim 16 (original): The system of claim 14 wherein at least one of the optical cavities is a microsphere.

Claim 17 (original): The system of claim 14 wherein at least one of the optical cavities is a toroidal microcavity.

Claim 18 (currently amended): The system of claim 14

wherein at least one of the optical cavities is an Indium Phosphide [[~~a InP~~]] microdisk.

Claim 19 (currently amended): The system of claim 14 wherein [[~~at least one of~~]] the oligonucleotides are complementary to a target [[~~substances is~~]] DNA.

Claim 20 (currently amended): The system of claim 14 wherein [[~~at least one of~~]] the oligonucleotides are complementary to a target [[~~substances is~~]] RNA.

Claim 21 (original): The system of claim 14 wherein, if a target substance hybridizes with oligonucleotides on the surface of an optical cavity surface, a shift in the resonance of that optical cavity of a first amount occurs, and

wherein if a substance which differs from the target substance by a single nucleotide is made available for hybridization with the surface of the optical cavity surface, a shift in the resonance of the optical cavity of a second amount occurs, wherein the first amount is detectably greater than the second amount.

Claim 22 (original): The system of claim 21 wherein the first amount is at least ten times greater than the second amount.

Claim 23 (original): The system of claim 14 wherein the oligonucleotides provided on at least one of the optical cavities are 11-mer oligonucleotides.

Claim 24 (original): The system of claim 14 wherein the

oligonucleotides provided on at least one of the optical cavities are at least 27-mer oligonucleotides.

Claim 25 (original): The system of claim 14 wherein the oligonucleotides provided on at least one of the optical cavities are at least 11-mer oligonucleotides.

Claim 26 (original): The system of claim 14 wherein the oligonucleotides provided on at least one of the optical cavities are at most 27-mer oligonucleotides.

Claim 27 (original): The system of claim 14 wherein the processor determines the measurement of the target substance using a shift in characteristic of the resonances detected by the detector, and refractive indices of the optical cavity and a solution in which the target substance is allowed to come into contact with the optical cavity.

Claim 28 (original): The system of claim 27 wherein the processor determines the measurement of the target substance further using an excess polarizability of a volume of the target over an equal volume of a solution in which the target is provided.

Claim 29 (original): The system of claim 14, wherein the optical cavity is a microsphere, and

wherein the processor determines the measurement of the target substance using a shift in characteristic of the resonances detected by the detector, and a radius of the microsphere.

Claim 30 (original): The system of claim 14 wherein the

measurement of the target substance is a surface density of the target substance bound to the optical cavity.

Claim 31 (original): The system of claim 14 wherein the at least one optical carrier includes a plurality of optical fibers.

Claim 32 (original): The system of claim 31 wherein each of the plurality of optical fibers is optically coupled with at least two of the optical cavities.

Claim 33 (original): The system of claim 31 further comprising at least one additional light detector,
wherein at least two of the plurality of optical fibers are optically coupled with a common light source, but with different light detectors.

Claims 34-39 (canceled)

Claim 40 (new): The sensor of claim 1 further comprising:
c) two substantially parallel substrates accommodating each of the at least two optical cavities.

Claim 41 (new): The sensor of claim 40 wherein the at least one optical carrier is arranged between the two substantially parallel substrates.